Automation

Robohand FERGUSON

CAMCO

GENERAL SERVICE MANUAL
INDEX DRIVES

WARNING

This is a controlled document. It is your responsibility to deliver this information to the end user of the CAMCO or FERGUSON product. Failure to deliver this could result in your liability for injury to the user or damage to the machine. For copies of this manual, call your Customer Service Representative at 800-645-5207

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Introduction

CAMCO Index Drives are engineered and manufactured to very high tolerances which necessitate careful inspection and maintenance. This manual is a general guide to lubrication, troubleshooting and general information about index drives.

In addition to this General Service Manual, Industrial Motion Control, LLC (IMC) has other service manuals devoted to the specific model CAMCO index drive you are using. The model-specific service manuals cover disassembly and assembly of the major components. They also contain an exploded view drawing of the index drive with a complete bill of materials for identifying and ordering spare or replacement parts.

Some users of index drives have the facilities and trained personnel to accomplish service repair. You must determine the extent to which intricate servicing should be done in your own facility. When in doubt, IMC recommends that IMC trained service technicians make the repairs.

How to Use This Service Manual

1. This manual deals covers general service and maintenance subjects. In addition to this manual you should have the model-specific service manual. You may request a copy from your local IMC Sales Representative, directly from IMC (847-459-5200 / camco@destaco.com) or download a copy from the IMC website: www.camcoindex.com.

2. The Model Number Interpretation section will assist you in identifying the model you have and the characteristics of your index drive

3. The Troubleshooting Guide will help you diagnose potential problems.

4. This manual will explain how to order parts or return an Index Drive to IMC for repair. **IMPORTANT:** The Bill of Materials listed in the model-specific service manual is for a standard unit. If you feel you have a special unit, or are in doubt, please use the procedures outlined in the “How to Order Parts” section.

5. Read all ***CAUTIONS*** and ***WARNINGS*** prior to service or repair.

6. Read **WARRANTY** prior to service or repair.

Warranty

IMC products are warranted for one (1) year from the date of shipment to be free from defects in workmanship and materials

The foregoing warranty is exclusive and in lieu of all other warranties, whether written or orally expressed or implied and there are no warranties of merchantability or fitness for particular use.

IMC’s obligation under the foregoing is limited to replace free of charge, including the lowest transportation cost, but not including installation or any other charges, any part that our inspection shows to be defective provided that the part was properly installed, suitably maintained and not subject to misuse or abuse, and further provided that the defective parts are returned to our plant within one (1) year after delivery by us. Written permission for such return must first be obtained from IMC. A complete explanation is required of the alleged defects and circumstances.

See the "How to Return for Repair" section of this manual.

Warnings and Cautions

Statements in this manual preceded by the words ***WARNING*** or ***CAUTION*** and printed in ***italics*** are very important. We recommend you take special notice of these during service or repair.

WARNING
Means there is the possibility of personal injury to yourself or others.

CAUTION
Means there is the possibility of damage to the CAMCO unit.

Interpretation of Index Drive Model Numbers

In an effort to better understand the type of Index Drive you have purchased, the complete model number as it appears on the name tag can be divided into five (5) main components.

CAMCO EXAMPLE: 250P4H20-270

250	P	4	H20-	270
(1)	(2)	(3)	(4)	(5)

1. The basic CAMCO model series, usually the pitch diameter of the cam follower circle (i.e. 250 means 2.5" diameter).

2. The type of cam and output configuration
   - P = Parallel cam unit
   - RA = Right angle cam unit
   - RAD = Right angle cam / dial mounting output
   - RD = Roller gear cam / dial mounting output
   - RG = Roller gear cam unit
   - RDM = Roller gear cam / dial mounting output / motorized
   - RNG = Ring index drive
   - E = Heavy duty right angle cam units / dial mounting

3. The number of stops.

   Four (4) stops means the output shaft will make four starts and stops during one complete 360 degree revolution. The angle of each segment of output rotation (index distance) is found by dividing 360 by the number of stops.

   EXAMPLE: 4 stops = 360/4 = 90° per index

4. Cam follower size in 32nds of an inch.

   For example
   H20 = 20/32 = .625 inch diameter followers
   H96 = 96/32 = 3.00 inch diameter followers

5. Cam motion in degrees.

   The cam is divided into two basic parts, motion and dwell. Motion is the angular segment in which the cam does its work rotating the output shaft one complete index.

After motion is complete the cam is considered to be in dwell for the reminder of the 360° rotation. During dwell the output of the Index Drive is stationary even though the input shaft continues to rotate.

Example: For a 270° motion, during 270° of input rotation the output shaft makes one index. During the remaining 90° of input rotation the output is stationary.

IMPORTANT NOTE: Some CAMCO units are called "type 2" units. In this case the cam has two motion periods and two dwell periods on the cam.

Example: 250P6H20-270 Type 2 (also shown as Type II)

For 135° on input rotation the output shaft makes one index. During the next 45° of input rotation the output does not move. For the next 135° of input rotation the output makes a second index. During the next 45° of input rotation the output does not move. In summary, two complete cycles of index and dwell are provided for one rotation of the input shaft. Therefore, 50RPM at the input (cam) shaft equals 100 indexes/minute.

Index Drive Basic Service Requirements

1. The Index Drive oil level should be checked monthly and oil added as required to maintain proper level.

2. The oil should be changed as outlined in the lubrication section.

3. All grease fittings should be lubricated with the recommended grease once per month.

4. All index drive mounting bolts should be checked for tightness after three months of service and annually thereafter.

5. Cam followers should be inspected every 8000 hours of operation.

Inspection of Cam Followers

The cam followers should be inspected every 8000 hours of operation. Backlash at any station indicates worn or damaged cam followers. Any binding during rotation of the input shaft could indicate broken cam followers.

To inspect for excessive backlash, place the indexer in a dwell position and check for looseness by physically trying to force the dial or crank arm back and forth. Excessive looseness (.0015” at 6" radius) indicates replacement of the cam followers is required and the Index Drive should be returned to IMC for repair.

Contact your local IMC representative for assistance if necessary.

Index Drive Lubrication Data

OIL LEVEL

CAMCO Index Drives are furnished with a "bulls-eye" type oil level sight gauge. The oil level should be checked when the unit is stopped at which time the oil level should reach the center of the sight glass (see page 3 for estimated oil capacity). During oil changes this "bulls-eye" can be removed for cleaning.

CAUTION: *CAMCO units are shipped without oil. Be sure to fill prior to initial startup.*

OIL CHANGE

An oil change is required every 2000 hours of operation, or every six months whichever occurs first. Where operating conditions are severe, such as rapid rise and fall in temperature of the indexer housing (which is accompanied by sweating of the inside walls with a resulting formation of sludge), where operation is in moist and dusty atmospheres, or in the presence of chemical fumes, it may be necessary to change the oil in intervals of one to three months.

> **NOTE**: The magnetic drain plug should be visually inspected at this time for metallic chips that might indicate failure of one of the internal components.

TYPE OF OIL

Lubricating oils should be high quality, well-refined petroleum oils or synthetic lubricants with extreme pressure additives. They may be subjected to high operating temperatures, so they must have good resistance to oxidation.

IMC recommends the following:

- **General applications:** ISO 220 grade oils with EP additives such as MOBILGEAR 630 (Exxon-Mobil) or OMALA 220 (Shell Oil).
- **Severe applications or for longer life:** Oil that meets API-GL-5 and Mil Spec 2105D/E parameters such as Mobilube HD Plus 80W90 (conventional) or Mobil Delvac Synthetic Gear Oil 75W90 (synthetic)
- **Servo-controlled applications:** use Mobil SHC 634 (Exxon-Mobil).

> **NOTE**: When the gear reducer and Index Drive have a common oil reservoir (as with the 902RDM Index Drive and the R250 reducer), an AGMA #8 compound is recommended. One such lubricant is Exxon-Mobil's 600 W SUPER CYLINDER OIL.
>
> **NOTE:** If you cannot locate the oil listed your supplier should be able to cross reference to another brand.
>
> **NOTE**: For lubricants used in Gear Reducers not sharing common oil with Index Drives see the GEAR REDUCER SERVICE SECTION. DO NOT use oils with EP Additives in Gear Reducers.

GREASE PACKED BEARINGS

Bearings that are accessed by oil in the indexer reservoir require no additional maintenance. Bearings not lubricated by the oil in this way are normally packed with a high quality bearing grease. However, **bearings that are not lubricated by the oil reservoir or by grease packing will require periodic greasing.** Bearings of this type will be furnished with a grease fitting and should be greased with NGLI #2 bearing grease (such as MOBILGREASE XHP222) at least once per month. Do not over lube since the excess grease will eventually fall into the indexer oil reservoir.

Index Drive Oil Capacities (Approximate)

For indexers mounted in the normal* position. Consult IMC for units not listed.

Model No.	US. (quarts)	Metric (liters)	Model No.	U.S. (quarts)	Metric (liters)
80RDM	*Grease filled***		40RGD/S	6 oz.	0.2
601RDM	2	2	50RGD/S	16 oz.	0.5
902RDM	3	3	70RGD/S	20-24 oz.	0.6-0.7
1100RDM	8	8	80RGD/S	30-38 oz.	1-1.1
1305RDM	9	9	110RGD/S	C/F	C/F
1800RDM	36	34			
			350RGD/S	1	1.4
425RD	2	2	500RGD/S	5	4.7
800RD	5	5	700RGD/S	10	9.5
1301RD	14	13			
1801RD	36	34	1100RNG	C/F	C/F
			1550RNG	C/F	C/F
250P	1	1	2050RNG	C/F	C/F
387P	2	2			
512P	5	5	750E	C/F	C/F
662P	10	10	950E	10 gallons	38
900P	20	19	1150E	25 gallons	95
1200P	48	45	1550E	40 gallons	152
1800P	95	90	2050E	45 gallons	171
			2750E	75 gallons	285
401RA (C)	1	1			
512RA(CC)	2	2	150RPP	2.5	2.4
662RA(CCM)	6	6	300RPP	4	4
663RAD(DR)	4	4	500RPP	10	9
900RAD(GH)	6	6	900RPP	48	45

* Normal indexer mounting position is output vertical over input on all models except the "Parallel series" (P) in which normal mounting is output horizontal, even with input. “Output Vertical” refers to the direction of the center of rotation. For dial-type indexers, this is the position with the dial horizontal.

** “Grease-filled” units are shipped with grease. Grease should only need to be added if the unit is disassembled for rebuild or repair.

C/F: Consult IMC for information

Oil Seal Installation Recommendations

IMC recommends that all seals be replaced any time the device is being disassembled regardless of whether they are damaged or not. Most damage to oil seals occurs at assembly when recommended seal installation procedures are not followed.

1. Check dimensions -- to be sure that shaft and bore diameters match those specified for the seal selected.

2. Check seal -- for damage that may have occurred prior to installation. A sealing lip that is turned back, cut or otherwise damaged should be replaced.

3. Check bore -- to see that the leading edge is deburred. A rounded corner of chamfer should be provided.

4. Check shaft -- remove surface nicks, burrs and grooves and look for spiral machine marks that can damage the seal lip.

5. Check shaft end -- remove burrs or sharp edges. The shaft end should be chamfered.

6. Check splines and keyways -- smooth any sharp edges and when necessary protect the seal lip with an assembly sleeve or shim stock. Round the edges of the spline or keyway as much as possible and lubricate with a hard, fibrous grease.

7. Check seal direction -- make sure that the new seal faces in the same direction as the original. Generally, the lip faces the lubricant or fluid to be sealed.

8. Pre-lubricate the sealing element -- before installation by wiping with lubricant being retained.

9. Use the correct installation tool -- press fitting tools should have outside diameter .010" smaller than the bore size. If possible, the center of tool should be relieved so pressure is applied only at the outer diameter of the seal.

10. Use proper driving force -- where possible, an arbor press; otherwise, a dead blow hammer to avoid popping the spring out of the seal. NEVER HAMMER DIRECTLY ON THE SURFACE OF THE SEAL.

11. Bottom out the tool or seal -- to avoid cocking of the seal in the bore. This also positions the seal correctly on the shaft.

12. Check for parts interference -- from other machine parts that might rub against the seal causing friction and damaging heat.

Gear Reducer Service Data

CAMCO Index Drives use two basic makes of reducers. These are IMC (R180, R225, R260) and Cone (7300C, 7350C, etc.). The service data list below is intended to cover both in a general manner. For other types of reducers, consult the manual supplied with the reducer or contact IMC.

1. For reducers supplied with a sight glass, the oil level should be checked monthly and the recommended oil added as required to maintain the proper oil level.

2. The oil should be changed as outlined in the lubrication section.

3. All grease fittings should be lubricated with the recommended grease once per month.

4. The reducer, particularly finned areas and fan covers. should be kept clean to allow maximum heat dissipation. (Excessive accumulation of dirt and grease will effect proper cooling of the unit).

5. All reducer and foundation bolts should be checked for tightness after three months of service and annually thereafter.

6. A change in sound level or excessive vibration can indicate low oil level, abnormal loading or worn elements.

7. During operation, a worn gear may run hot. However, unless the temperature exceeds 200° F. (93° C) there is no cause for alarm.

Gear Reducer Lubrication Data

OIL LEVEL

Most reducers are furnished with a "bull's eye" type sight glass or a pipe plug to indicate oil level. In either case an oil level tag is affixed to the reducer near the oil level indicator. Oil level should be checked with the unit stopped. Estimated oil capacities for standard reducers are listed on page 13.

CAUTION: *IMC ships all gear reducers without oil (except the R180, R225 and R260). Be sure to fill to proper level prior to startup.*

OIL CHANGE - WORM GEAR REDUCER LUBRICATION

Lubricating oils used for gear reducers should be high quality, well refined petroleum or synthetic lubricants. These oils should be ISO 460 grade. Change the oil every 2000 hours of operation, or every six months whichever occurs first.

NOTE: Failure to comply with oil change intervals may void warranty.

TYPE OF OIL

Lubricating oils used for gear reducers should be high quality well refined petroleum oils. See the lubrication bulletin provided with your particular reducer or request one from IMC.

> ***NOTE:*** **Cone Drive Worm Gear Reducers:** Mobil 600W Cylinder oil (conventional) or Mobil SHC-634 oil (synthetic).
>
> ***CAUTION****:* Do not use oil with EP additives in the reducer.
>
> ***CAUTION:*** Newer **R180** and **R260** reducers (date codes K11K and newer) require Mobil Glygoyle 460. This oil is not compatible with standard mineral or synthetic oils. Mobil Glygoyle 460 or equivalent must be used.

VISCOSITY

Oils recommended for AGMA #7C & #8C compound must have a minimum viscosity index of 90 (see chart - page 9).

GREASE PACKED BEARINGS

Bearings that are at least partially submerged in oil or oiled by internal oil scoops do not require special maintenance. However, bearings that are not lubricated as above require grease lubrication. Grease fittings and internal retainers are furnished as required. They should be greased with NGLI #2 bearing grease at normal maintenance intervals.

OIL CAPACITY

	Capacity			Capacity			Capacity	
Model	**(quarts)**	**(liters)**	**Model**	**(quarts)**	**(liters)**	**Model**	**(quarts)**	**(liters)**
R180	5 oz.	.15	7250C	1	.9	7500C	1.75	6.6
R225	1	.9	7300C	1.5	1.4	7600C	2.75	10.4
R260	1	.9	7350C	3.5	3.3	Camco R200	1	.9
7200C	1	.9	7400C	1 gal.	3.8	Camco R250	1.5	1.4

NOTE: The above capacities are maximum values. The capacity may vary depending upon the mounting position.

Overload Clutch

GENERAL

The CAMCO plunger-type output overload clutch is a reliable minimum service overload device requiring very little attention (in a semi-clean environment) during its service life. The environment is an important factor in the successful functioning of this device. A dusty or corrosive environment may require special preparation or attention. (Contact IMC for special modifications). High humidity, contaminants, or wash down applications may also require special protection. If rust forms within the clutch, it may act as a solid coupling and will not release under overload conditions, (See lubrication procedures).

> **NOTE**: For complete installation, operation and maintenance instructions, including component identification drawing, contact IMC.

LUBRICATION

Under normal conditions the overload clutch will not require lubrication on a scheduled basis but the overload clutch should be tested at least once every 6 months to be sure it is functioning properly. To do this the output member (sprocket, dial, pulley, shaft etc.) should be locked by mechanical means, then attempt to hand crank the reducer input shaft (or input shaft of the index drive if a reducer is not used). By locking the output member the clutch should trip during index of the drive. If the clutch does not function you could break a follower or cam during normal operation. Therefore, the clutch should be taken apart, (as outlined in the "Clutch Installation, Operation and Maintenance Instruction Manual" - Note all warnings and cautions) cleaned and a light coat of MOBILGREASE XHP222 grease applied to the drive plate and mating surface of the clutch body. Also, lubricate the spring pockets with a light film of grease.

CAUTION: *Heavy lubrication in the spring pockets may lock the plunger, due to hydraulic pressure, preventing the clutch from disengagement. In dusty, corrosive, high humidity, contaminants or wash down environments, lubrication (as outlined above) should take place at least once every six (6) months or sooner if required.*

Long Term Reducer/Indexer Storage

1. Standard Shipping Procedure - Protection for Maximum Storage Duration of 30 Days.

   Most Indexers are run-in tested using a rust inhibiting oil, drained, painted with one coat of CAMCO metallic Blue, and all exposed shafting coated with a rust preventative prior to shipment. This procedure is intended to protect the Indexers during shipment and short term inside storage for a maximum period of thirty (30) days after shipment.

2. Long Term Storage (Indoors) for Periods up to One Year.

   (a) Fill the Indexers completely full with one of the lubricants shown on our indexer list of lubricants.
   (b) Rotate the reducer worm shaft until you have completed one revolution of the output. Rotate a least once per month to keep the seals from sticking to the wear rings and or shafts.
   (c) If it is not practical to rotate the input shafts periodically we recommend purchasing a set of oil seals to have on hand in the event of seal leakage at start-up.
   (d) Before putting the Indexers into service, lower the oil in the Indexers to the proper operating oil level.

3. Long Term Storage (Outdoors) for Periods up to One Year.

   Proceed as in (2) above with the following additions.
   (a) After filling the unit with oil, plug the breather hole with a pipe plug and wire the breather to the unit.
   (b) Coat all exposed shafting with long term rust preventative.

4. Extended Storage periods Exceeding One Year.

   (a) Coat all exposed shafts with a long term rust preventative.
   (b) Place the unit in a heavy plastic bag and put approximately 1/2 oz. #260 "VPI" powder in the bag. Seal the bag air tight.
   (c) Crate the unit and cover the crate to keep out water.
   (d) Purchase a spare set of oil seals to have on hand at start-up.

Troubleshooting Guide

IMC recommends that only technicians experienced in index drives maintenance make repairs. A full year warranty is given on any unit rebuilt by IMC.

If the customer must rebuild the unit themselves, they should refer to the individual service manual that applies to theirs model index drive. They should follow step-by-step procedures for isassembly and assembly as described in theses manuals. Cautions and warnings should also be followed.

NOTE: IMC will not warrant any unit rebuilt by the customer.

SYMPTOM: INDEXER APPEARS INACCURATE

1. Check if unit stops in dwell. See the assembly drawing for your unit for keyway position in dwell. Also refer to cycle cam and limit switch function in this manual.
2. Is the output shaft backlash-free in dwell? Be sure to disconnect all other devices from the indexer output including an overload clutch. All indexers must be backlash-free in dwell (see Symptom: Looseness in Dwell).
3. How is the unit being checked? IMC uses a computer controlled checking machine to check each index against a theoretical perfect index. Contact the factory for assistance. IMC keeps inspection reports for units with special accuracy (units required to be within closer tolerances than standard).

SYMPTOM: LOOSENESS IN ONE DWELL

1. Followers are worn and need replacing.
2. Follower wheel is damaged and needs rework or replacement.

SYMPTOM: LOOSENESS IN EACH DWELL

1. Camshaft is loose in bearings. Check for end play in input shaft. Adjust shims on bearing caps. See individual service manual for preload setting procedures.
2. Cam is loose on shaft. Usually repaired at the factory.
3. Cam is broken. (This rarely happens and is an indication of an overload application or a jam).
4. Unit was very heavily overloaded and all bearings loosened up. Factory rework required.

5. All followers are worn. Rebuilding by factory is best remedy.
6. Output shaft to follower wheel connection is loose. Factory repair is recommended.
7. Customer output member connection loose. Tighten output member and dowel in place.

SYMPTOM: INDEXER IS NOISY

1. Check if output is backlash-free in dwell.
2. Check for excess looseness in motion. Cam or follower could be broken
3. Is the noise from the reducer rather than the indexer?
4. Occasionally, variable speed D.C. controls cause the input to pulsate and create noise. Adjust the Internal Resistance Compensation within control.
5. Are input and output connections backlash free?
6. Is the unit overloaded? Loads can change over a period of time due to wear.
7. Is the unit support (base) rigid?
8. The unit could be overheated and have loose preload.
9. Is there sufficient oil in the unit? Is oil used consistent with IMC specifications? (See *Index Drive Lubrication*)

SYMPTOM: PREMATURE WEAR ON FOLLOWERS

1. Actual forces on the unit could be greater than calculated due to loose input or output.
2. Lack of oil or wrong oil used (See Lubrication section of Index Drive Service).
3. Frequent or severe overloads.
4. Improper input systems (where there is not a constant velocity input) will cause an erratic output or excessive output vibration. This will result in forces several times higher than calculated (see input recommendations).
5. Defective cam or follower wheel assembly.

SYMPTOM: OUTPUT MOVEMENT IS ERRATIC AND VIBRATING

1. Input does not run at a constant velocity. The prime objective of a good input connection to an Index Drive is to maintain a constant shock free velocity (see input recommendations). Motor running too slowly could also cause an erratic output.
2. Output connections loose, flexing, or winding up. Check all connections (see recommended output connections).
3. Excessive friction drag on output. Disconnect indexer and investigate friction torque.
4. Unit is overloaded due to excessive speed or loads. Contact your Sales Agent to check data sheet application loads and speeds. Decrease speed.
5. Unit could be internally damaged. Check other symptoms.
6. Unit support is not rigid. Check rigidity of index drive mount with an indicator. Stiffen support or decrease speed.

Recommended Input Configuration

The prime objective of a good input connection to an Index Drive is to maintain a constant shock-free velocity.

Both the type of motor driving the indexer and the type of connection is of equal importance. Here we explain some of the advantages and disadvantages of these factors.

1. **Worm gear** reducers with a high reduction provide two features. First, the flywheel energy due to the high speed of the input. Secondly, the low efficiency of a worm gear reduces the effects of back-driving and thus prevents input speed fluctuations.

2. **Timing belts** may be used if a worm gear drive is not suitable because of low gear reduction or shaft arrangement requirements. Timing belts are desirable due to zero backlash and if properly sized they have a long life. Timing belts also provide a flywheel effect of the pulleys and are service free. (Note: Use tapered bushings in all pulleys and use a high service factor). The pulleys selected should be as large as possible and the belts as short as possible to maximize the flywheel effect, and minimize belt flexing.

3. **Zero backlash or rigid couplings** are suitable, especially with tapered bushings. During installation, special care is required to assure alignment of the couplings. When selecting a coupling a high service factor must be used. Brands available are Thomas Coupling, Rexnord, Zurn Industries, etc. Some customers have been successful with rigid couplings, but alignment of shaft becomes critical. Shaft failures are common in these situations.

4. **Gears and chains** are not very desirable and should be used only if no other method is possible. Gears should be set to minimum backlash and maximized in size. Unless enclosed and oil lubricated, only slow speeds are acceptable. Chains stretch and have backlash. A larger sprocket size helps and some customers have been successful with self-adjusting idler arrangements.

5. **Line shafting** - Torsional windup is just as undesirable as backlash.

CAUTION: *Long slender line shafts, rubber insert couplings, long belts and spongy mountings will drastically increase actual torque demand which in turn raises torsional windup. Breakage or severe vibration can result.*

6. Permanent magnet motors fulfill two objectives, low cost and low inertia, but are at a disadvantage for flywheel energy. This is especially serious for large dial and reciprocating applications. IMC does not recommend operating permanent magnet motors below 1000RPM, and for very heavy loads the minimum speed is 1500RPM or more. Failure to maintain these minimum speeds will result in erratic input speeds and unpredictable torque levels.

7. Air and hydraulic motors can cause considerable problems. The inherent low inertia of these motors and the resulting lack of adequate stored flywheel energy do not provide a reliable constant input velocity.

Recommended Output Configuration

The objective of a good output connection to an Index Drive is to make torque levels predictable and limited in magnitude. A good connection is rigid and free of backlash.

IMC recommends that a CAMCO output overload clutch be used with index drives whenever possible. This will prevent costly damage to the unit in the event of a jam and eliminate costly down time.

Our preference for output connections is as follows and in this order:

1. **Flange mountings are superior**. A properly bolted and dowelled connection will provide a good connection for dials, sprockets, gears and overload clutches. IMC provides output flanges on most CAMCO indexers for this reason.

2. **Zero backlash or rigid couplings** are suitable, especially with tapered bushing. During installation, special care is required to assure alignment of the coupling. When selecting a coupling a high service factor must be used. Brands available are Thomas Coupling, Rexnord, Zurn Industries, etc. Some customers have been successful with rigid couplings, but alignment of shaft becomes critical. Shaft failures are common in these situations.

3. **Timing belt drives** if sized properly are an excellent drive. Unfortunately, proper sized means large and thus can seldom be used on higher speed applications. The timing belt drive tends to use up a significant amount of available index drive capacity.

4. **Gears and chains are not very desirable** and should be used only if no other method is possible. Gears should be set to minimum backlash and maximized in size. Unless enclosed and oil lubricated, only slow speeds are acceptable. Chains stretch and have backlash. Again, a larger sprocket size helps and some customers have been successful with self-adjusting idler arrangements.

CAUTION: *Torsional windup in line shafting is just as undesirable as backlash. Long slender line shafts, rubber insert couplings, long belts and spongy mountings will drastically increase actual torque demand which in turn raises torsional windup. Breakage or severe vibration may result.*

5. For the calculations on any Indexer or Oscillator drive application to be of any value, both the input and output connections must be "stiff" and free of backlash. This is as important as the sizing of the Index Drive itself.

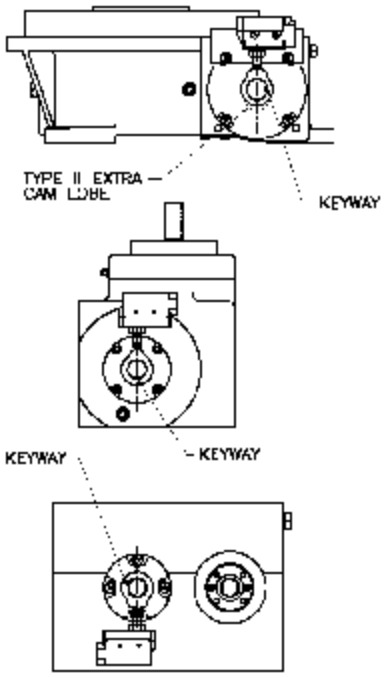
Cam & Limit Switch Functions

Cam & Limit Switches serve two purposes:

1. Some customers desire an electrical signal somewhere during dwell in order to trigger another device such as a cylinder, punch press, loader, etc.

2. To signal the dwell position for a cycle on demand application. In cycling, the input is signaled to stop somewhere in dwell position. This stopping may be done either by stopping the motor or using a clutch brake to disconnect the motor from indexer input. Either of these methods allows operation of the Index Drive near its rated capacity (shortest motion time) and, by controlling the time the indexer stops, give the customer his desired dwell time.

INPUT SHAFT KEYWAY POSITION AT CENTER OF DWELL



ROLLER GEAR
A Standard Roller Gear unit with Cam & Limit Switch mounted on the housing has a correct keyway dwell position of directly opposite the output (center of rotation), 90° CW from the cam lobe. The Cam & Limit Switch may also be mounted on the reducer. NOTE: On some RDM units (such as the 601RDM), the Cam and Limit Switch is mounted on an angle. Cam and Limit Switch may also be mounted on the reducer

RIGHT ANGLE
A standard right angle unit with the cam and limit switch mounted on the housing has a correct keyway dwell position directly opposite of the cam lobe. Cam and Limit Switch may also be mounted on the reducer

PARALLEL
A standard parallel unit with the cam & limit switch mounted on the housing has a correct keyway dwell position directly opposite of the output shaft, 90° from the Cam lobe. Cam and Limit Switch may also be mounted on the reducer

CAUTION: *There are several ways to misapply the limit switch. One of the most common problems is failure to stop the unit in dwell. Starting and stopping in motion may overload the indexer and open up or trip the overload clutch (if supplied).*

The dwell position can be found by checking the indexer output for movement by means of an indicator or by observing the appropriate notes in our IMC assembly drawings.

Type 2 motions require double-lobe trip cams since one revolution of the input has two dwells. Type 2 units are typically used when a higher number of stops is required. Please remember that IMC cannot preset the trip cam. Every customer has different requirements which make standardization very difficult.

Another potential problem is double indexing. This can happen if the limit switch does not close the contacts for a sufficient period necessary to energize the holding relay. Higher speed operation or an improperly adjusted limit switch may cause this problem.

How to Order Parts

Please refer to the Parts List applicable to your specific model as shown in the model-specific service manual. This Parts List is for a standard Index Drive. If you feel your drive in non-standard or you are in doubt you should contact IMC Customer Service (847) 459-5200 and request a bill of material for your specific unit (based on serial number).

You may order parts by using the Standard Bill of Material even if your unit is non-standard. IMC's Parts Department will review the closed order file based on the following information and supply you with the correct part.

REQUIRED INFORMATION:

1. Serial number (located on name plate)
2. Model number (located on name plate)
3. Original purchase order number (if available)
4. Customer name (original purchaser of drive)
5. Approximate date of purchase

TO ORDER PARTS contact the IMC PARTS DEPARTMENT, Wheeling, Illinois, Phone (847) 459-5200 or Fax (847) 459-3064.

A. Describe the part required and the 14 digit part number as listed in the Standard Bill of Materials or a Special Bill of Materials pertaining to your specific unit (state which bill is being used, Standard or Special bill).

B. Give as much of the above required information as possible.

ON WARRANTY

IMC will send replacement part freight prepaid via the most practical means. IMC will issue a "Returned Material Authorization Number" (RMA#) for the return of the defective parts for inspection. IMC will bill the customer for repair parts. When inspection of the returned parts has been completed and determined to be a warranty problem IMC will issue credit to the customer for the repair parts and freight charges.

ON NON-WARRANTY

Replacement or spare parts, with approved credit, are sent F.O.B. IMC Plant, Wheeling, Illinois.

How to Return Equipment for Repair

Please contact the IMC Repair Department in Wheeling, Illinois at (847) 459-5200 for a "Return Material Authorization" Number (RMA#).

The following information is required of a unit for repair, conversion or warranty.

1. Purchase order number
2. Customer name
3. Customer billing address
4. Customer shipping address
5. Person to contact, upon inspection, with delivery and price.
6. Telephone number
7. Model number (located on name plate)
8. Serial number (located on name plate)
9. Description of defects, problems or circumstances.

IMC Repair Department will assess repairs by phone and estimate inspection fees or repair costs.

Non-warranty inspection fees will vary depending on the size of the unit and optional equipment mounted. These fees apply only if customer decides not to repair or replace subject unit.

Please return IMC equipment only (remove sprockets, pulleys, etc). This will reduce the amount of disassembly time (saving labor costs) and will provide faster evaluation for quoting price and delivery of repair or conversion.

Pack unit to protect it from weather or damage during shipping. **Place the (RMA#) on the outside of the packaging for prompt service.**

Ship Warranty units via surface freight collect.

Ship Non-Warranty units to IMC transportation prepaid. IMC will not accept collect shipments on non-warranty repairs

Ship to:

INDUSTRIAL MOTION CONTROL, LLC
1444 South Wolf Road
Wheeling, Illinois 60090 - USA
Tel: 847-459-5200
Fax: 847-459-3064
Toll Free: 800-645-5207

Indexer Weights

Right Angle

Model	lbs	kg
301RA	15	6.8
400RA	33	15.0
401RA	55	24.9
512RA	80	36.3
662RA	160	72.6
663RAD	130	59.0
900RAD	220	99.8
1200RAD	850	385.6

Parallel

Model	lbs	kg
250P	18	8.2
387P	55	24.9
512P	135	61.2
662P	430	195.0
900P	750	340.2
1200P	1100	499.0
1800P	3000	1360.8

Roller Gear

Model	lbs	kg
350RG	35	15.9
500RG	350	158.8
600RG	390	176.9
700RG	400	181.4
80RDM	19	8.6
601RDM	70	31.8
902RDM	130	59.0
1100RDM	192	87.1
1305RDM	305	138.3
1800RDM	1400	635.0
425RD	110	49.9
800RD	450	204.1
1301RD	1000	453.6
1801RD	2400	1088.6

Heavy-Duty

Model	lbs	kg
750E	5000	2268.0
950E	5500	2494.8
1150E	6000	2721.6
1550E	18000	8164.7
2050E	54000	24494.2

Ring Drive

1100RNG	C/F	C/F
1550RNG	C/F	C/F

Mini/Metric Roller Gear

Model	lbs	kg
32RG	2.8	1.3
40RG	6	2.7
50RG	18	8.2
70RG	25	11.3
80RG	65	29.5

Overload Clutches

Model	lbs	kg
0.39	5	2.3
2.3	10	4.5
4	17	7.7
6	25	11.3
7.8	20	9.1
11	40	18.1
18	75	34.0
35	57	25.9
31	123	55.8

Torq/Gard

Model	lbs	kg
TG3	1.5	0.7
TG6	2	0.9
TG20	3.2	1.5
TG60	6	2.7
TG200	12	5.4
TG400	43	19.5
TG800	43	19.5

Cambots

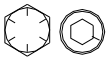
Model	lbs	kg
150RPP	45	20.4
300RPP	110	49.9
500RPP	300	136.1
900RPP	575	260.8
140LPP	55	24.9
240LPP	80	36.3
380LPP	200	90.7
4120LPP	340	154.2

MISCELLANEOUS

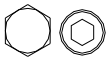
Model	lbs	kg
R180	10	4.5
R225	25	11.3
R260	25	11.3
7300C	89	40.4
7350C	123	55.8
7400C	180	81.6
7500C	307	139.3

Note: Weights shown are shipping weights without oil.
C/F: Consult IMC for information

Recommended Tightening Torque Values for Cap Screws

Thread Size	SAE Grade 2 Torque Spec. (ft/lbs)		SAE Grade 5 Torque Spec (ft/lbs)		SAE Grade 8 Torque Spec (ft/lbs) 	
	into Aluminum	into Steel	into Aluminum	into Steel	into Aluminum	into Steel
.250-20	3.7	5.5	5.3	8	8	12
.250-28	4.1	6.2	6.7	10	9.3	14
.312-18	7.3	11	11	17	16	24
.375-16	13	20	20	30	30	45
.375-24	15	23	23	35	33	50
.437-14	21	32	33	50	46	70
.437-20	24	36	36	55	53	80
.500-13	33	50	50	75	73	110
.500-20	36	55	56	85	80	120
.562-12	46	70	73	110	100	150
.562-18	53	80	80	120	113	170
.625-11	66	100	100	150	140	210
.625-18	73	110	113	170	160	240
.750-10	116	175	173	260	253	380
.750-16	133	200	200	300	280	420
.875-9	113	170	286	430	400	600
.875-14	119	180	313	470	446	670
1.00-8	166	250	426	640	606	910
1.00-14	186	280	480	720	680	1020
1.12-7	233	350	526	790	860	1290
1.12-12	266	400	593	890	960	1440
1.25-7	333	500	746	1120	1213	1820
1.25-12	366	550	826	1240	1340	2010
1.50-6	580	870	1300	1950	2106	3160
1.50-12	563	980	1466	2200	2373	3560
Spiralock Thread						
.250-20SL*	4.3	6.3	6.1	9	11.5	14

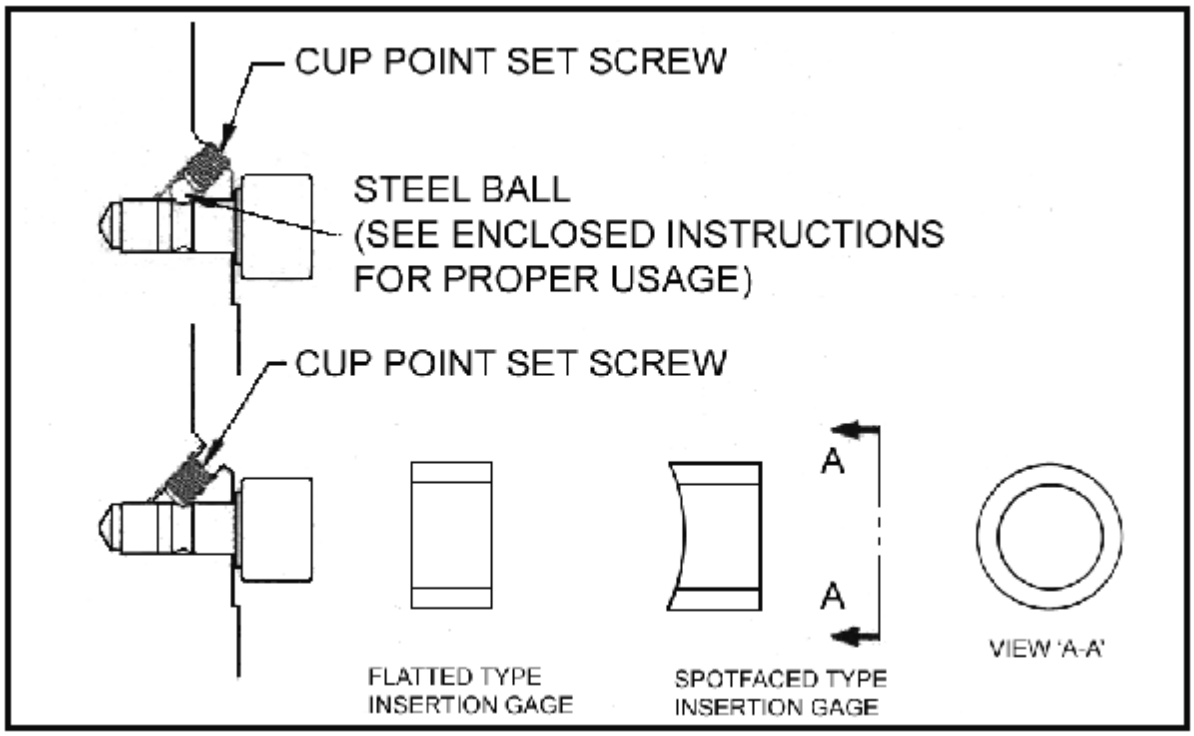
* Used on 601RDM Housing and input cartridge

Thread Size	NAAMS STD F-2.3				Thread Size 	NAAMS STD F-2.3			
	Into Steel		Into Aluminum			Into Steel		Into Aluminum	
10.9/12.9	Nm	Ft-lb	Nm	Ft-lb	8.8	Nm	Ft-lb	Nm	Ft-lb
M6x1.0	16	12	11	8	M6x1.0	10.5	7.7	7	5
M8x1.25	39	29	26	19	M8x1.25	26	19	17	13
M10x1.5	77	57	50	37	M10x1.5	51	37	34	25
M12x1.75	135	100	89	66	M12x1.75	89	65	59	43
M16x2.0	335	247	220	163	M16x2.0	215	158	143	105
M20x2.5	650	480	430	315	M20x2.5	420	309	280	205
M24x3.0	1130	834	745	550	M24x3.0	725	534	483	355
M30x3.5	2240	1653	1478	1090	M30x3.5	1450	1069	965	712

Note: Torque values are for non-lubricated cap screws, coated only with a residual film of oil, as received from the manufacture and a thread locking solution applied to the threads. IMC recommends "Loctite Removable Threadlocker 242" be applied to all fasteners and tapped holes at assembly

IMPORTANT!!!

Cam Follower Installation Procedure



The H9 thru H32 (.287" thru 1.00" diameter) Cam Followers require a Steel Ball/Set Screw and an insertion gage for installation. The steel ball/set screw is used to anchor the cam followers to the follower wheel and the insertion gage kit is used to insure proper installation. The new cam followers need to be pressed onto the follower wheel to the position prescribed by the gage (if they are pressed in too far, the will not turn freely).

Cam Follower Installation Procedure

1. Obtain spare parts kit, cam followers and insertion gage kit.
2. Select proper insertion gage. The spot-faced type gage should be used if the cam follower mounting surface is spot-faced. If no spot face is present, the flatted type gage should be used (see gage illustration, above).
3. Place insertion gage around the outer diameter of the cam follower while pressing onto the follower wheel.
4. Refer to the following chart to determine if the steel ball and set screw or the set screw only* should be used for anchoring the cam follower. The anchoring hardware may not always align exactly with the groove on the cam follower but it will always align within an acceptable range. The cup point style set screw is always required.

* If steel balls and set screws were supplied with the original unit, continue using steel balls and set screws (reuse original set or use set provided in the spare parts kit).

Table: Cam Follower Anchoring Method

MODEL	CAM FOLLOWER	DIAMETER (INCHES)	ANCHORING METHOD
MINIATURE RGD/RGS	H9 thru H24	.287 thru .750	BALL/SET SCREW
350RGD / RGS	H20 thru H32	.750 thru 1.00	BALL/SET SCREW
350RG	H20 thru H24	.625 thru .750	SET SCREW ONLY *
500RGD / RGS	H28 thru H32	.875 thru 1.000	BALL/SET SCREW
500RG	H28 thru H32	.875 thru 1.000	SET SCREW ONLY *
80RDM	H16	.500	BALL/SET SCREW
80RDM	H20	.625	SET SCREW ONLY *
600RDM	H20 thru H24	.625 thru .750	SET SCREW ONLY *
601RDM	H20 thru H24	.625 thru .750	BALL/SET SCREW
900RDM or 901RDM	H20 thru H32	.625 thru 1.000	SET SCREW ONLY *
902RDM	H20 thru H28	.625 thru .875	SET SCREW ONLY *
902RDM	H32	1.000	BALL/SET SCREW
1305RDM	H28 thru H32	.875 thru 1.000	BALL/SET SCREW
425RD	H20 thru H28	.625 thru .875	SET SCREW ONLY *
425RD	H32	1.000	BALL/SET SCREW
800RD	H28 thru H32	.875 thru 1.000	SET SCREW ONLY *
150RPP LIFT & ROTARY	H20	.625	BALL/SET SCREW
300RPP ROTARY	H24	.750	SET SCREW ONLY *
300RPP LIFT	H24	.750	BALL/SET SCREW
500RPP ROTARY	H24 thru H32	.750 thru 1.000	SET SCREW ONLY *
500RPP LIFT	H24 thru H28	.750 thru .875	SET SCREW ONLY *
500RPP LIFT	H32	1.000	BALL/SET SCREW
240LPP	H20	.625	BALL/SET SCREW
240LPP	H24	.750	SET SCREW ONLY *
380LPP	H24	.750	BALL/SET SCREW
380LPP	H32	1.000	SET SCREW ONLY *

* If steel balls and set screws were supplied with the original unit, continue using steel balls and set screws (reuse original set or use set provided in the spare parts kit).

Table: Cam Follower Part Numbers

CAM FOLLOWER SIZE	DIAMETER (INCHES)	NEW PN	OBSOLETE PN
H9	.287	82C33150150003	82A48589000000
H12	.366	82C33150160003	82A49590000000
H14	.445	82C33150170003	82A49591000000
H16	.500	82C33150100003	82C33150060003
H18	.563	82C33150180003	82A49592000000
H20	.625	82C33150110003	82C33150010003
H24	.750	82C33150120003	82C33150020003
H28	.875	82C33150130003	82C33150030003
H32	1.000	82C33150140003	82C33150040003

Table: Insertion Gage Kit Part Numbers

MODEL	CAM FOLLOWER	DIAMETER (INCH)	INSERTION GAGE KIT
MINIATURE RGD/RGS	H9	.287	99A73572000000
MINIATURE RGD/RGS	H12	.366	99A73571000000
MINIATURE RGD/RGS	H14	.445	99A73570000000
MINIATURE RGD/RGS	H16	.500	99A73568000000
MINIATURE RGD/RGS	H18	.563	99A73569000000
MINIATURE RGD/RGS	H20	.625	99A73560000000
MINIATURE RGD/RGS	H24	.750	99A73565000000
MINIATURE RGD/RGS	H28	.875	99A73567000000
110RGD / RGS	H20	.625	99A73560000000

MODEL	CAM FOLLOWER	DIAMETER (INCH)	INSERTION GAGE KIT
110RGD / RGS	H24	.750	99A73565000000
110RGD / RGS	H28	.875	99A73567000000
140RGD / RGS	H24	.750	99A73565000000
140RGD / RGS	H28	.875	99A73567000000
350RGD / RGS	H20	.625	IGS350RGDH20
350RGD / RGS	H24	.750	IGS350RGDH24
350RG	H20	.625	48A73573000000
350RG	H24	.750	48A73574000000
500RGD / RGS	H28	.875	IGS500RGDH28
500RG	H28	.875	58A73587000000
80RDM	H16	.500	IGS80RDMH16
80RDM	H20	.625	IGS80RDMH20
600RDM	H20	.625	56A73580000000
600RDM	H24	.750	99A73565000000
601RDM	H20	.625	IGS601RDMH20
601RDM	H24	.750	IGS601RDMH24
901RDM	H20	.625	56A73580000000
901RDM	H24	.750	56A73581000000
901RDM	H28	.875	56A73582000000
902RDM	H20	.625	IGS902RDMH20
902RDM	H24	.750	IGS902RDMH24
902RDM	H28	.875	IGS902RDMH28
1305RDM	H20	.625	IGS1305RDMH20
1305RDM	H24	.750	IGS1305RDMH24
1305RDM	H28	.875	IGS1305RDMH28
425RD	H24	.750	IGS425RDH24
425RD	H28	.875	IGS425RDH28
800RD	H28	.875	IGS800RDH28
150RPP ROTARY	H20	.625	IGS150RPPH20
150RPP LIFT	H20	.625	48A73573000000
150RPP LIFT	H24	.750	IGS150RPPH24L
300RPP LIFT & ROTARY	H24	.750	IGS300RPPH24
500RPP ROTARY	H24	.750	IGS500RPPH24
500RPP ROTARY	H28	.875	IGS500RPPH28
500RPP LIFT	H24	.750	03A73593000000
500RPP LIFT	H28	.875	03A73590000000
900RPP RECIP	H24	. .750	99A73565000000
240LPP	H20	.625	IGS240LPPH20
240LPP	H24	.750	IGS240LPPH24
380LPP	H24	.750	IGS380LPPH24

* H32 cam followers do not require insertion gage kit

Table: Steel Ball & Set Screw Compatibility Chart

If spare parts kit is not ordered, ball & set screw must be ordered separately (at no cost)

MODEL	CAM FOLLOWER	DIAMETER (INCH)	PART NUMBER
40RGD / RGS	H9	.287	95A3304103000 SET SCREW 95A67373010000 STEEL BALL
40RGD / RGS	H9 thru H12	.287 thru .750	95A33041020000 SET SCREW 95A67373010000 STEEL BALL
50RGD / RGS	H12	.750	95A33041030000 SET SCREW 95A67373010000 STEEL BALL
50RGD / RGS	H14 thru H18	.445 thru .563	95A33041110000 SET SCREW 95A67373000000 STEEL BALL
70RGD / RGS	H14 thru H20	.445 thru .625	95A33041110000 SET SCREW 95A67373000000 STEEL BALL

MODEL	CAM FOLLOWER	DIAMETER (INCH)	PART NUMBER
80RGD / RGS	H18	.563	95A33041110000 SET SCREW 95A67373000000 STEEL BALL
80RGD / RGS	H20 thru H28	.625 thru .875	95A33041170000 SET SCREW 95A67373030000 STEEL BALL
350RG	H20 thru H24	.625 thru .750	95A26005320000 SET SCREW
350RGD / RGS	H20 thru H24	.625 thru .750	95A26005310000 SET SCREW 95A67373000000 STEEL BALL
350RGD / RGS	H32	1.000	95A26005300000 SET SCREW 95A67373000000 STEEL BALL
500RG	H28	.875	95A26005330000 SET SCREW
500RGD / RGS	H28	.875	95A26005300000 SET SCREW 95A67373000000 STEEL BALL
500RG	H32	1.000	95A26005450000 SET SCREW
500RGD / RGS	H32	1.000	95A26005440000 SET SCREW 95A67373020000 STEEL BALL
80RDM	H16	.500	95A33041110000 SET SCREW 95A67373000000 STEEL BALL
80RDM	H20	.625	95A33041180000 SET SCREW 95A67373020000 STEEL BALL
600RDM	H20 thru H24	.625 thru .750	95A26005300000 SET SCREW
601RDM	H20 thru H24	.625 thru .750	95A26005290000 SET SCREW 95A67373000000 STEEL BALL
900RDM	H32	1.000	95A26005440000 SET SCREW
901RDM	H20 thru H28	.625 thru .750	95A26005320000 SET SCREW
902RDM	H20 thru H28	.625 thru .750	95A26005320000 SET SCREW 95A67373000000 STEEL BALL
901RDM	H32	1.000	95A26005440000 SET SCREW
902RDM	H32	1.000	95A26005420000 SET SCREW 95A67373020000 STEEL BALL
1305RDM	H28	.875	95A26005320000 SET SCREW 95A67373000000 STEEL BALL
1305RDM	H32	1.000	95A26005420000 SET SCREW 95A67373020000 STEEL BALL
425RD	H20 thru H32	.625 thru 1.000	95A26005420000 SET SCREW 95A67373020000 STEEL BALL
800RD	H28 thru H32	.875 thru 1.000	95A26005450000 SET SCREW 95A67373020000 STEEL BALL
150RPP LIFT & ROTARY	H20	.625	95A26005300000 SET SCREW 95A67373000000 STEEL BALL
300RPP LIFT & ROTARY	H24	.750	95A26005300000 SET SCREW 95A67373000000 STEEL BALL
500RPP LIFT & ROTARY	H24 thru H28	.750 thru .875	95A26005300000 SET SCREW 95A67373000000 STEEL BALL
500RPP LIFT &ROTARY	H32	1.000	95A26005420000 SET SCREW 95A67373020000 STEEL BALL
240LPP LIFT & TRANSFER	H20	.625	95A26005290000 SET SCREW 95A67373000000 STEEL BALL
240LPP LIFT & TRANSFER	H24	.750	95A26005310000 SET SCREW 95A67373000000 STEEL BALL
380LPP LIFT	H24	.750	95A26005300000 SET SCREW 95A67373000000 STEEL BALL
380LPP TRANSFER	H32	1.000	95A26005420000 SET SCREW 95A67373020000 STEEL BALL

NOTES

NOTES

Automation

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CAMCO

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